An Analysis of Pear Psylla Populations 1977-79

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ABSTRACT

The pear psylla, *Psylla pyricola* Foerst., may be controlled in unsprayed orchards by midseason by the hemipteran predators, *Anthocoris* spp. and *Deraeocoris* spp. In commercial orchards, the impact of predators is minimized because of pesticide usage. Application of pesticides for pear psylla and other insects and mites decimates populations of all pear psylla parasites and predators. In some instances, single applications of synthetic pyrethroid insecticides, directed at the ovipositing overwintered pear psylla females, successfully controlled pear psylla through harvesttime and allowed reentrance of predators in late season. Extended warm weather during the falls of 1978 and 1979 enhanced late-season buildup of large overwintering populations of pear psylla that were not controlled by attending predator populations.

KEYWORDS: Pear psylla, *Psylla pyricola*, insecticides, pears, pear pest management, predators, *Anthocoris*, *Deraeocoris*, *Phytocoris*, *Nabis*, *Campylomma*, *Chrysopa*, *Hemerobius*, ladybird beetles, developmental suppression, high temperatures.

CONTENTS

AN ANALYSIS OF PEAR PSYLLA POPULATIONS, 1977-79[1]

By R. E. Fye[2]

INTRODUCTION

The low return on large production investments in the late 1970's has forced many pear growers to review the various facets associated with production. Their analyses have shown that costs of controlling pear insect pests (as much as $250 per acre) severely reduced the net return. The major pear insect pest requiring control was the pear psylla, *Psylla pyricola* Foerst. The pear psylla problem in California, the Pacific Northwest, and British Columbia, Canada, has been discussed by several authors in the past two decades (*1*, *2*, *7*, *21*).[3]

The feeding of the nymphs of the pear psylla results in much honeydew, which drips on the pear fruit, becomes overgrown with sooty mold, and causes a severe russeting that reduces the quality of the pears. In large sustained infestations, the pear trees may be debilitated with a resulting loss of vigor and yield. This study was conducted to determine why certain growers had highly successful control programs for the pear psylla while others had marginal or ineffective controls. The grower programs were highly variable in approach and results because dissimilar climatic, soil, and cultural conditions exist in the various parts of the Yakima Valley.

METHODS

A preliminary evaluation of the pear psylla and the attendant predators populations was made in 1977. In 1978 and 1979, the evaluations were continued in more detail. In 1978, five commercial orchards were monitored to determine the insect populations on the trees and population responses to grower management. In 1979, the insect populations in seven commercial orchards, including the five monitored in 1978, were assessed.

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[1] Research financed in part by a grant from the Washington State Tree Fruit Research Commission.

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[3] Italic numbers in parentheses refer to Literature Cited, p. 7.

The insect populations were sampled at weekly intervals from early March through October or until the foliage had senesced so that it could no longer support the pear psylla. Before the trees had leafed out, 25 fruit spurs in each orchard were examined for the eggs of pear psylla. When the leaves had opened adequately, three leaves from vegetative spurs and three from fruit spurs were examined from each of 25 trees per orchard. When new shoot growth commenced, three young leaves, taken randomly along the shoot, were also examined. The immature psylla populations were determined by visual examination with a microscope. In addition, the populations of pear psylla adults and predators in pear trees were evaluated by the beating tray method (*3*). Fifteen trays (three limb taps over each 45- x 45-cm tray) were taken in each orchard each week. Therefore, the total sample within each orchard each week consisted of 225 leaves to determine the immature psylla population and 15 beating trays to determine the adult pear psylla and predator populations. At the end of the season, when the foliage became mature and the leaves dropped, the leaf samples were discontinued, but the beating tray samples were continued into November.

RESULTS

Descriptions of the orchards, notes on the horticultural practices, and the insecticide programs of the various growers are presented in the Appendix. The immature psylla densities and beating tray results are presented in bar graphs utilizing a slightly modified logarithmic scale to better delineate the variations in the populations at low levels.

The predators include the larval, nymphal, and adult stages of *Anthocoris* spp., *Deraeocoris* spp., *Campylomma verbasci* (Meyer), *Nabis* spp., *Phytocoris* spp., *Chrysopa* spp., *Hemerobius* spp., earwigs, *Coccinella transversoguttata* Fald., *Adalia bipunctata* (Linn.), and spiders.

The 1977 data from the laboratory orchard (fig. 1)[4] show a large egg deposition by the overwintering females. In late April and early May, however, an apparent influx of overwintering predators, mainly *Anthocoris melanocerus* Reuter, maintained the immature pear psylla population at less than one per leaf until early June and then departed. The apparent maintenance of low pear psylla levels during late July and early August may be attributed to extended periods of relatively hot, dry weather (*13*, *14*).

In 1978, a late emergence or buildup of predators resulted in the survival of a large number of the first generation of pear psylla (fig. 2). As a consequence, the adult psylla population remained relatively high throughout the season, and the early, heavier, immature population precluded midseason control by the limited number of predators. When the population of immature pear psylla was reduced to about one per leaf in late July, however, the predators departed, and the fall population of adults attained high levels due to the minimal predation on the immatures.

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[4]All figures are shown in the Appendix.

In 1979, the large spring egg deposition and resulting nymphs were controlled early in the season by a large early emerging population of predators, mainly *A. melanocerus* (fig. 3). Again, the population of immature pear psylla was reduced to a level that resulted in the departure of the predators, but this occurred after the immature population had been reduced considerably lower than it was in 1978. Increased survival of a reduced number of immature pear psylla, due to relaxed predator pressures, resulted in a buildup of overwintering adults in the fall. In both 1978 and 1979, an extended warm fall enabled a large number of the pear psylla to mature.

The data for the 3 years indicate that the naturally occurring predators, if present in adequate numbers, will efffectively control the pear psylla in midseason. Unfortunately, due to excessive fruit drop caused by a large population of codling moths, *Laspeyresia pomonella* (Linn.), we have been unable to determine if the pear psylla was controlled before damage occurred to the fruit. The late appearance of predators in 1978 also indicates that a late emergence and slow buildup of the predators will permit a large population of pear psylla to develop before the predators become effective.

The relatively heavy insecticide program of grower 1 (figs. 4 and 5) demonstrates the effectiveness of the two major insecticides currently used to control the pear psylla. Two early applications of fenvalerate[5] with two subsequent midsummer applications of amitraz controlled the pear psylla until harvest. When insecticidal pressure was relaxed, the survivors of the summer applications of insecticide were the genesis of a large fall population that overwintered. The absence of predator pressure, due to the lack of a major reservoir in an adjacent unsprayed area, may be a contributing factor to the major fall buildup. The need to apply additional miticides to control destructive mites indicates the suppression of predatory mites by the pesticides.

For more than 5 years, grower 2 had employed minimal applications of insecticide directed toward the pear psylla. In 1978, a similar program maintained the pear psylla at a low level but permitted a late fall buildup of overwintering adults (fig. 6). Although predators, mainly spiders, were present in relatively large populations in late season they failed to control the fall population increase. Likewise, the general absence of predators in the early season indicates that predators were not a major control factor. The control of a minimal overwintering population of adult pear psylla with Q-137 (see p. 10) was probably responsible for the slow-building population.

In 1979, the heavier overwintering population (fig. 7) was not as readily controlled with insecticides, and a stronger population survived. The surviving pear psylla coupled with an increasing population of codling moths and red mites necessitated a midseason application of pesticides that resulted in a severe reduction in the slowly developing population of predators, thus minimizing their impact in the late season. Consequently, the fall population of overwintering individuals was about double that of 1978. The 1978 data clearly demonstrate the benefits of the use of pesticides that are not broad spectrum insecticides;

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[5]See section on Pesticide Designations in the Appendix for trade name and chemical name.

however, the 1979 data show the potential rapid regrowth of populations of pear psylla after summer applications of insecticides.

Grower 3 employed a single dormant spray of fenvalerate that resulted in economic control for the entire season (fig. 8). There was a gradual buildup of the immature pear psylla, resulting in a population of adults that was of some concern when harvest approached. The damage from honeydew was apparently reduced and minimized by the overhead sprinkler system (*20*). The entry of a relatively large population of *Deraeocoris brevis* in late July suggested that an undetected major reservoir of the predator existed in the area. Subsequently, the population of *Deraeocoris* reduced the immature population in late August, September, and early October. The departure of the *Deraeocoris* population to hibernation sites, or in response to the lack of adequate prey, resulted in some survival of the immatures and a slight buildup of adults in late fall; however, the populations were smaller than those in orchards employing intense insecticide control programs (figs. 5, 10, and 12). The data indicate the benefits of a minimal insecticide program, the migratory ability of major predator, and the strong reproductive potential of those predators, particularly *D. brevis*.

In 1978, the control programs of grower 4 showed the effectiveness of strong early season control of pear psylla (fig. 9); however, in late July an application of amitraz was required. In the absence of additional applications, the survivors initiated large late-season populations. Predator pressures in late season were low due to the lack of a major reservoir (in an adjacent unsprayed area) to furnish the initiating populations. In 1979, the early populations of immatures were reduced by insecticide applications (fig. 10), but the survivors of the summer insecticide applications initiated a large potential population of overwintering adults in late fall. The predators were decimated by the insecticide applications and never recovered. The data demonstrate the rapid recovery of pear psylla populations when small numbers survive insecticide applications. The necessity for miticide applications indicated some weakness in the early season control or a reservoir of mites for reinfestation of the trees.

The 1978 early season control program of grower 5 controlled the overwintering adults and early season immatures of the pear psylla (fig. 11). Two applications of a phosmet-ethion combination permitted a slow buildup of the pear psylla in the midseason and resulted in very slight damage to the harvested fruit. After harvest, there was a rapid buildup with a resulting large overwintering population. Predation was ineffective due to the lack of predators in early season and the absence of an unsprayed predator reservoir. The results in 1979 were similar to those in 1978, but the late-season buildup of overwintering forms was slightly less (fig. 12). The general overwintering populations in this orchard were larger than those with fewer applications of insecticides.

An early application of fenvalerate reduced the population overwintering adults and their progeny in the orchard of grower 6 (fig. 13). The low levels were maintained throughout midseason with July applications of detergent employed to minimize honeydew damage. Predator populations were generally low until late July and declined fairly rapidly in late September, resulting in a slight increase in the overwintering population of adults. The population of overwintering adults was lower than that in the orchards employing heavy pesti-

cide programs for the control of pear psylla (figs. 5, 10, and 12). A mite problem that arose in June was effectively controlled with cyhexatin.

In 1978, grower 7 employed a relatively intensive insecticide program that failed to control the pear psylla in midseason (fig. 14). A late-season application of phosmet had relatively little effect on the pear psylla population. After harvest, the pear psylla population increased rapidly, resulting in a large population of overwintering adults. The insecticide applications minimized the predator population in early season, but some recovery occurred from the latter part of July into October. The data emphasized the reproductive potential of the pear psylla and the capability of the insect for rapid recovery to high levels of infestation.

The data presented in figure 15 represent the populations of pear psylla and predators in pear trees interspersed in an apple block. The cover spray program for apples that the trees received aggravated the pear psylla population, and a large population infested the trees from late June through the remainder of the season. Any fruit borne on these trees would have been severely damaged. In late season, there was a strong buildup of predators, mainly *A. melanocerus*. The trees were removed at the conclusion of the 1978 season.

In 1979, the large population of overwintering pear psylla in the orchard of grower 7 was not fully controlled by the early season applications of insecticide (fig. 16). Subsequently, the summer applications left a number of survivors, which resulted in a large late-summer and overwintering population in the fall. The predator populations were controlled by insecticides throughout the summer; however, they recovered slightly in the fall when applications ceased. Again, a major overwintering population was produced in an orchard with a heavy summer insecticide history. The data also demonstrate the inability of late-season predation to make inroads into large populations of potentially overwintering pear psylla.

DISCUSSION

The 2-year study of pear orchards provides some insight into the results of current pear psylla control programs and documents a number of generally accepted ideas. Native *Anthocoris* and *Deraeocoris* have long been known to be effective predators of the pear psylla (*4, 6, 8, 9, 10, 11, 12, 15, 17, 18, 19, 22, 22, 23, 24*). In the current studies, *Anthocoris* spp. were the major predators during the midseason, and *Deraeocoris* was generally the major predator after the pears had been harvested.

Although the predators provided midseason control in unsprayed situations, they failed--through late emergence or slow buildup--to control the early immature forms of the pear psylla. In addition, their assumed propensity to leave an area when food supplies become inadequate permitted large fall buildups of overwintering pear psylla adults; however, late-season populations of predators, particularly *Deraeocoris*, have the capability of expanding greatly if an unsprayed reservoir is available to provide an initiating population after the insecticide applications are terminated. Other biocontrol organisms may reach population levels that provide some assistance to the major predators. These in-

clude *Trechnites insidiosus*, *Chrysopa* spp., *Adalia bipunctata*, and the spider complex. In localized situations, these parasites and predators have considerable impact upon the pear psylla (*24*).

High temperatures may have some impact on pear psylla population (13, 14). During the 1978 and 1979 season, the following periods of high temperatures occurred in the Yakima Valley:

	Number of hours with temperatures over:					
	30°C		32.5°C		35°C	
	1978	1979	1978	1979	1978	1979
April	7.0	0	3.5	0	0	0
May	0	0	0	0	0	0
June	49.0	23.5	11.0	2.5	0	0
July	58.4	58.0	17.5	19.5	1.5	0
August	147.5	9.5	82.5	0	19.5	0

Although some heat suppression of the pear psylla may have occurred during August of 1978, it was probably not extensive. In 1979, however, there was little indication that the high temperatures and not predation were responsible for the maintenance of relatively low levels of pear psylla (fig. 3). Additional research must be conducted to determine the full impact of heat suppression on pear insect populations.

The results from the grower insecticide programs indicate that the two materials currently available, fenvalerate and amitraz, are effective against the early season and midseason pear psylla populations, respectively. The need for thorough application is evident in the rapid rebuilding of the pear psylla populations to high levels after insecticide applications are terminated. A small number of survivors is adequate to initiate a large overwintering population. Hopefully, the low level survival in midseason (figs. 4, 5, 9, and 10) is due to escape from poor insecticide application and migration and not due to the pear psylla's propensity for rapid development of resistance to pesticides.

The recovery of populations of predators after single thorough applications of fenvalerate in the spring suggests a strong potential for integrated control; however, the potential is nullified when applications of pesticides are made for other pests, particularly codling moth and mites. An unsprayed reservior is essential for providing a source for reestablishing predator populations.

The large population increases in the pear psylla after the harvest of the fruit, when pesticide applications are discontinued, presents a paradox. A fall insecticide program for control of the overwintering population was suggested early (*5*) and is suggested in the current spray guide for eastern Washington (*16*).

The success of such programs may be seriously jeopardized by the migratory tendencies of the pear psylla and therefore requires that a large area be treated. Generally, the grower with an intense pesticide program is faced with a large fall population and is placed in the unresolved dilemma of applying pesticides to the overwintering generation in the fall, thus increasing the hazard of the potentially insecticide resistant pear psylla while still facing reinvasion of his orchard by migratory pear psylla in the spring.

The impact of overhead sprinkling systems on pear psylla has been investigated by Westigard et al. (*20*). They concluded that a major effect of overhead sprinklers is to reduce the damage by the pear psylla honeydew. Although detailed data on the impact of sprinklers were not included in our study, the tendency for minimized russeting damage in the two orchards with overhead sprinklers (figs. 6, 7, and 8) substantiates their observations.

The practice of interplanting pears with apples has generally been discontinued, but the data presented in figure 16 confirmed the need for separate programs for the two fruit. Obviously, pear psylla control in interplanted apples and pears requires adequate separation of trees for selective spraying.

The study suggests that judicious use of the available insecticides remains the strongest base for a prudent pear psylla control program; however, a program employing a number of practices, involving minimal use of hard pesticides, may become feasible if the available materials are lost to the grower for practical or regulatory reasons.

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APPENDIX

Pesticide Designations

Trade name	*Common name*	*Chemical name*
BAAM®	amitraz	(*N*,*N*'-[(methylimino)dimethylidyne] bis[2,4-xylidine]).
Diazinon®	diazinon	*O*,*O*-diethyl *O*-(2-isopropyl-6-methyl-4-pyrimidinyl)phosphorothioate.
Ethion	ethion	*O*,*O*,*O*',*O*'-tetraethyl *S*,*S*'methylene bis-(phosphorodithioate).
Ethyl parathion	parathion	*O*,*O*-diethyl *O*-(*p*-nitrophenyl)phosphorothioate.
Guthion®	azinphosmethyl	*O*,*O*-dimethyl *S*-[(4-oxo-1,2,3-benzotriazin-3(4H)-yl)methyl] phosphorodithioate.

Trade name	*Common name*	*Chemical name*
Imidan®	phosmet	*O,O*-dimethyl phosphorodithioate *S*-ester with *N*-(mercaptomethyl)phthalimide.
Karathane®	dinocap	2-(1-methylheptyl)-4,6-dinitrophenyl crotonate (commercial product is a reaction mixture containing several isomers).
Lime sulfur	calcium polysulfide	30-percent calcium polysulfide and various small amounts of calcium thiosulfate plus water and free sulfur.
Morestan®	oxythioquinox	cyclic *S,S*-(6-methyl-2,3-quinoxalinediyl) dithiocarbonate.
Perthane®	Q-137	1,1-dichloro-2,2-bis(*p*-ethylphenyl) ethane.
Plictran®	cyhexatin	tricyclohexylhydroxystannane.
Pydrin®	fenvalerate	cyano(3-phenoxyphenyl)methyl 4-chloro-α-(1-methyl=ethyl)benzeneacetate.
Solabar®	barium polysulfide	
Superior oil	petroleum oil	
Thiodan®	endosulfan	6,7,8,9,10,10-hexachloro-1,5,5a,6,-9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin 3-oxide.

Orchard Descriptions, Horticultural Practices, Insecticide Applications, Psylla Densities, and Beating Tray Results (Bar Graphs)

Yakima Agricultural Research Laboratory Orchard (figs. 1-3).

Location: Yakima.

Situation: Mature orchard (1 acre) with scattered replacement trees of variable age. Dwellings on south and west; laboratory on north, vegetable experimental plots on east beyond 2 acres of apples.

Irrigation: Rill.

Ground cover:

1977 - Light sod with strong admixture of weeds.

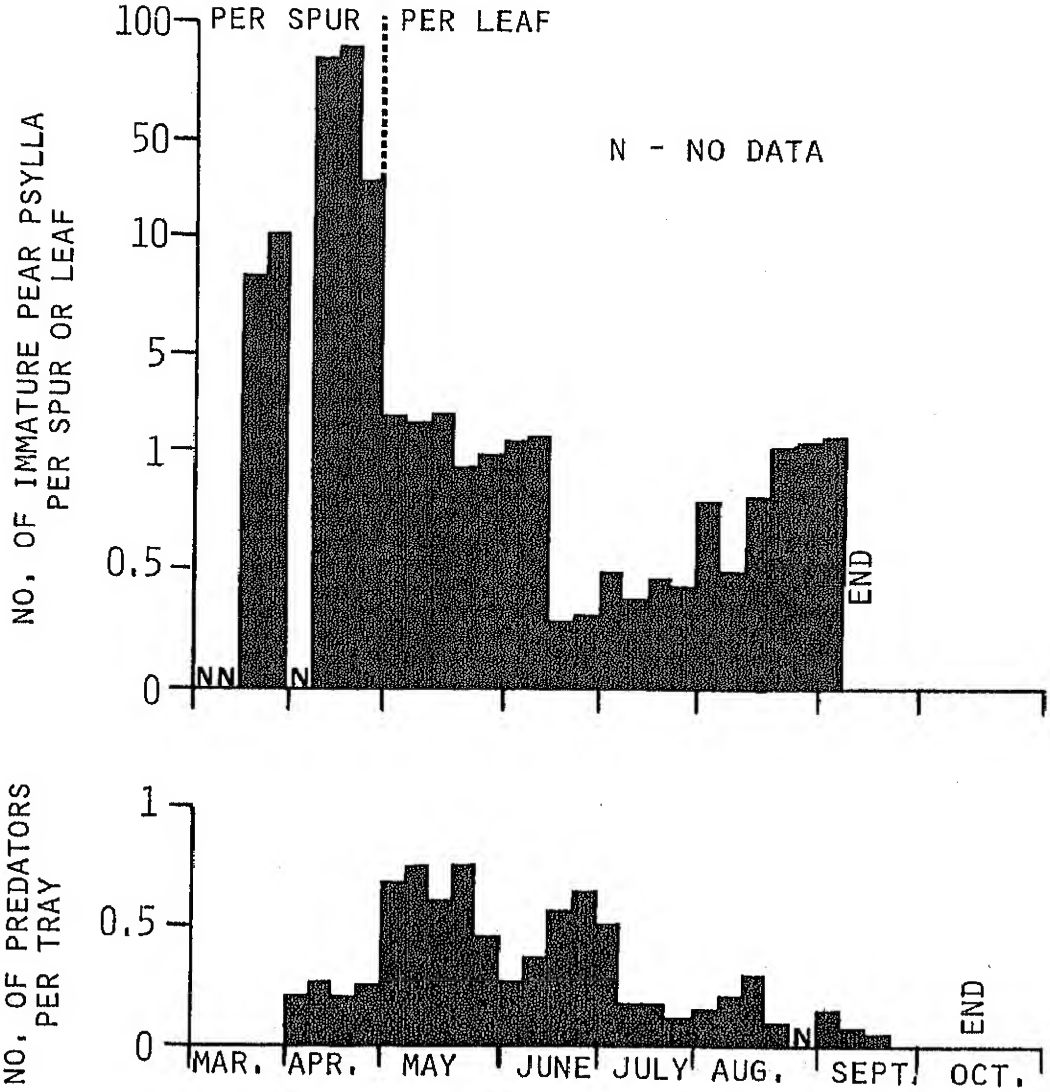

Figure 1.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of predators per tray. Yakima Agricultural Research Laboratory, Yakima, Wash., 1977.

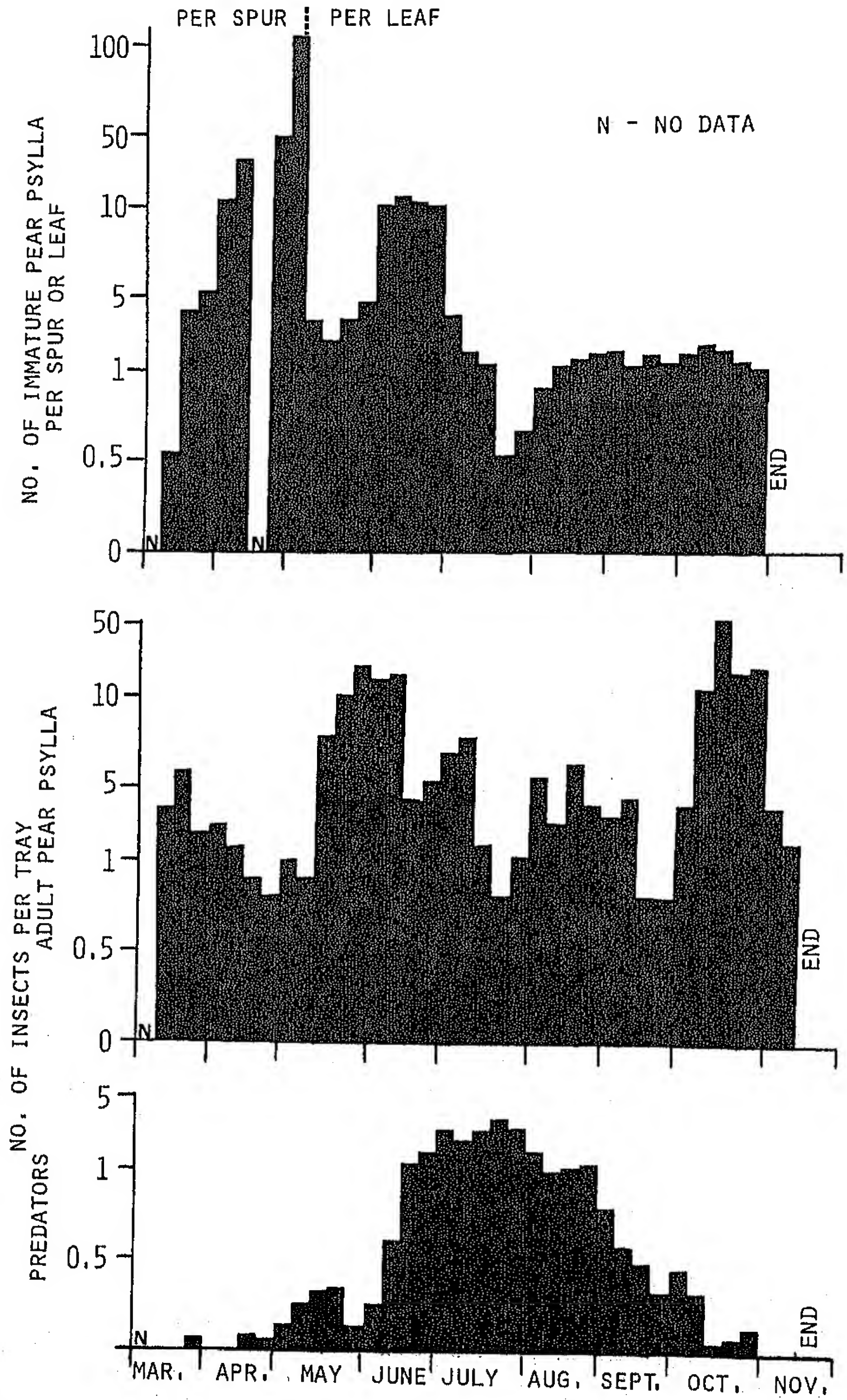

Figure 2.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Yakima Agricultural Research Laboratory, Yakima, Wash., 1978.

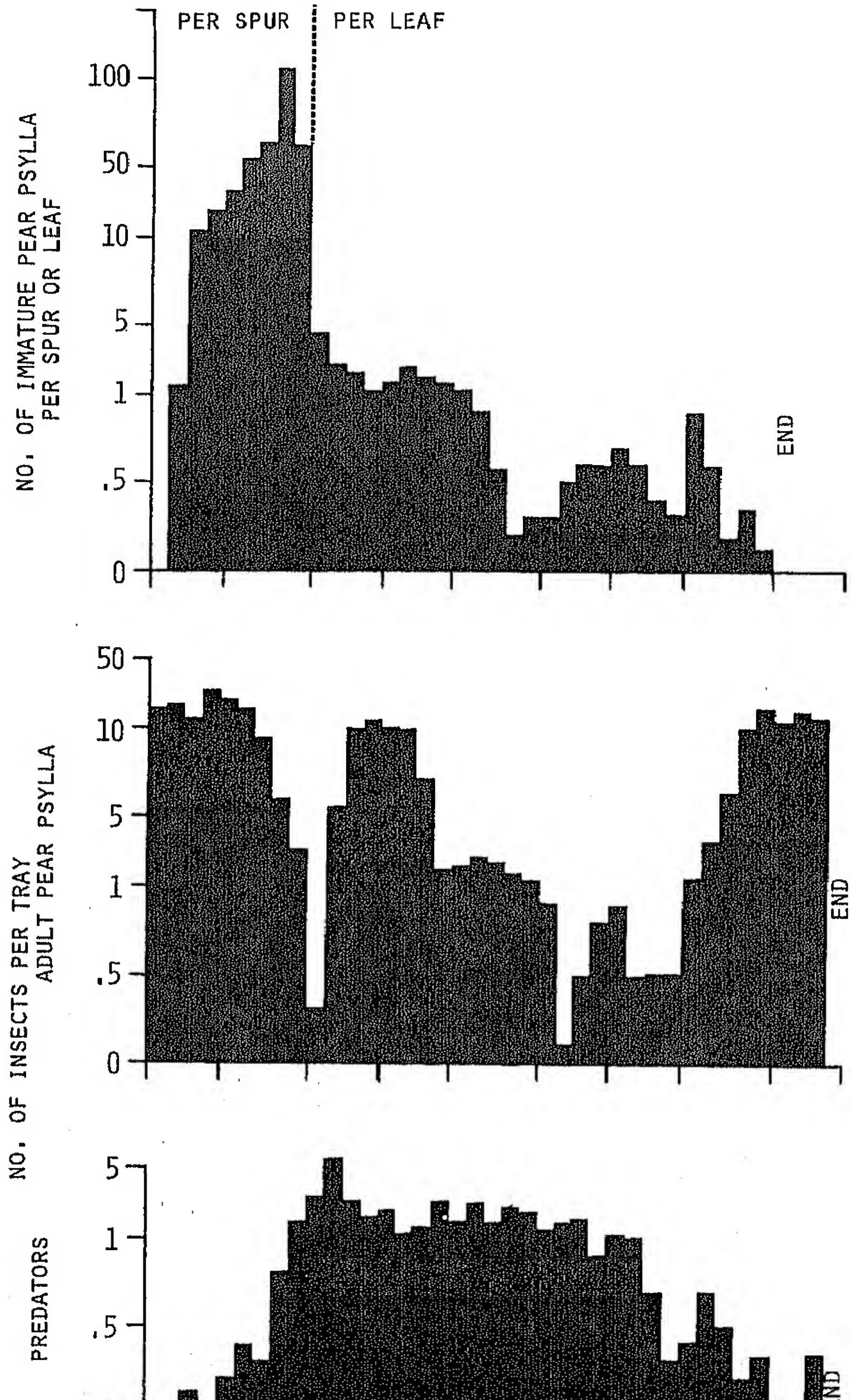

Figure 3.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Yakima Agricultural Research Laboratory, Yakima, Wash., 1979.

Ground cover: (Continued)

1978 - Early light sod with strong admixture of weeds. After July 15, disked, mostly bare soil. After August 15, experimental plantings of wheat and barley planted at weekly intervals until September 5.

1979 - Fall and spring planted wheat with heavy admixture of weeds. Grass and weeds in the tree root area.

Insecticide applications:

1977-79 None

Grower 1 (figs. 4 and 5)

Location: Yakima. North slope of Ahtanum Ridge.

Situation: Bearing orchard (about 50 acres) of even aged trees. Open field on north, bearing pear orchard on east, open field on south, open field on west. Some rows of d'Anjou pollinators.

Irrigation: Rill.

Ground cover: Cultivated, with small amounts of weeds escaping herbicide applications.

Insecticide applications:

1978

March 1	Superior Oil Pydrin®	4 gal/acre 0.3 lb AI/acre
March 24 May 23 July 10	Pydrin® Guthion® BAAM® Plictran® Guthion®	0.25 lb AI/acre 0.9 lb AI/acre 1.1 lb AI/acre 1.0 AI/acre 0.6 AI/acre
August 1	BAAM® Guthion®	0.8 lb AI/acre 0.75 AI/acre

1979

March 13	Superior Oil Pydrin®	5 gal/acre 0.2 lb AI/acre
April 6 May 2 June 25	Pydrin® Plictran® BAAM® Plictran®	0.2 lb AI/acre 1.0 lb AI/acre 1.1 lb AI/acre 0.75 lb AI/acre

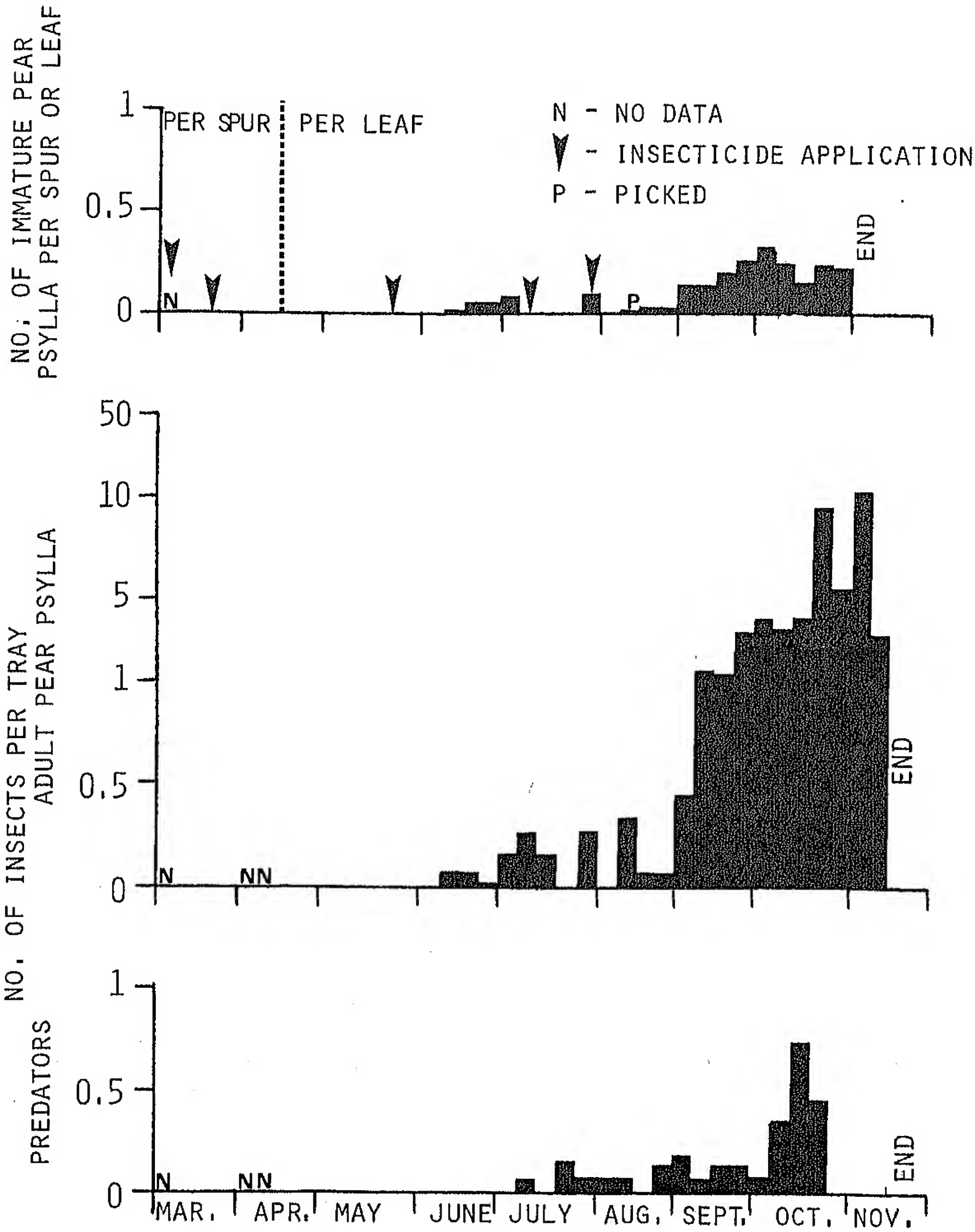

Figure 4.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 1, Yakima, Wash., 1978.

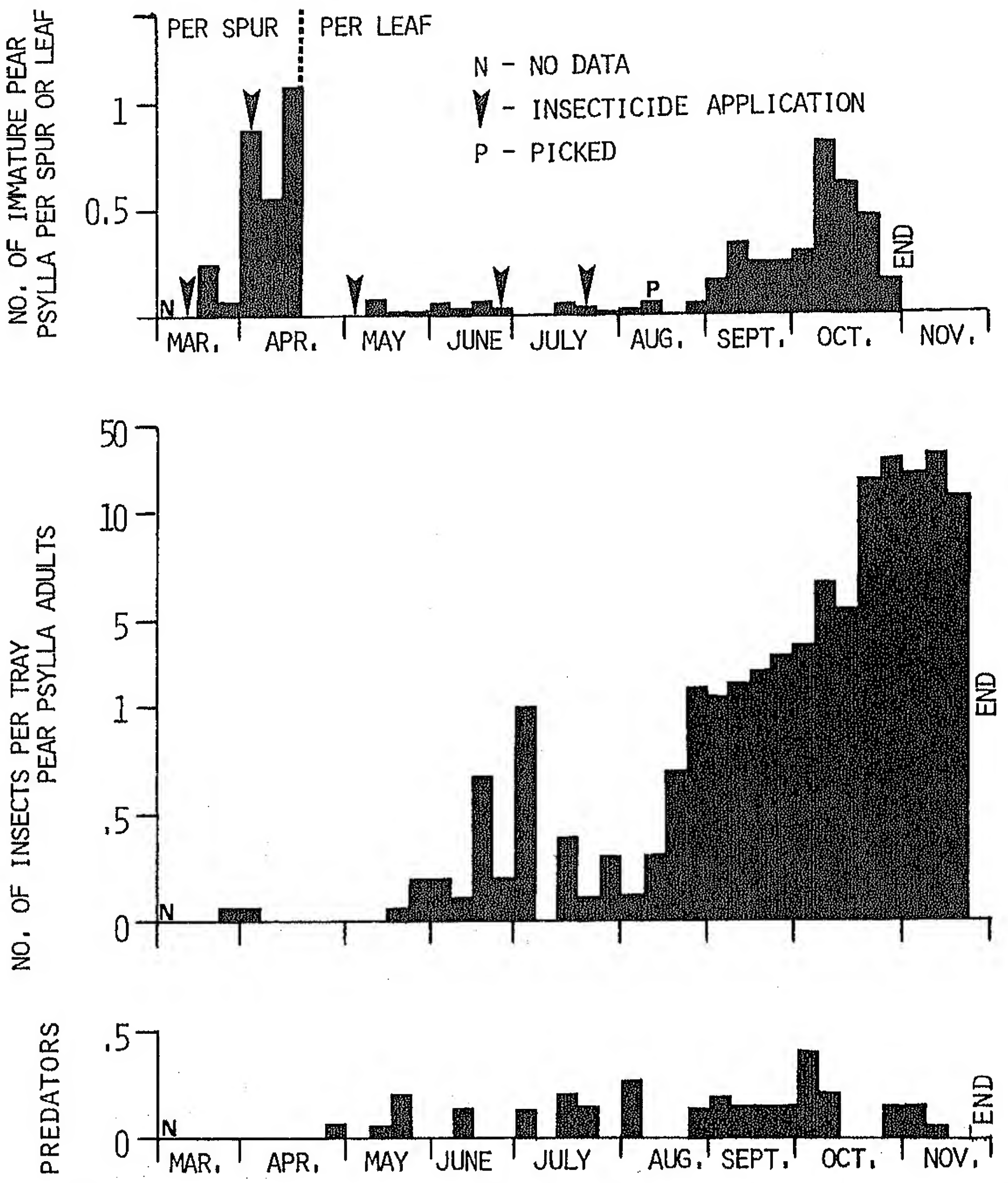

Figure 5.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 1, Yakima, Wash., 1979.

Insecticide applications: (Continued)

1979

July 27	BAAM®	0.8 lb AI/acre
	Plictran®	0.75 lb AI/acre
	Guthion®	0.75 lb AI/acre

Grower 2 (figs. 6 and 7)

Location: 4 miles north of Zillah.

Situation: Mixed orchard of bearing Bartlett and d'Anjous (5 acres). Row crops and alfalfa on east. Planted to apples in 1979. Five acres of apples on south. Asparagus on west, open range on north. Slight slope facing west.

Irrigation: Overhead sprinkler.

Ground cover: Dense weeds.

Insecticide applications:

1978

March 22	Superior Oil	1 gal/acre
	Perthane®	4 lb AI/acre
	Parathion	1.5 lb AI/acre
May 24	Diazinon®	2.5 lb AI/acre
June 20	Diazinon®	2.5 lb AI/acre
July 19	Diazinon®	2.5 lb AI/acre
October 19	Lime-sulfur	6 gal/acre

1979

March 17	Superior Oil	5 gal/acre
	Perthane®	2 lb AI/acre
March 23	Superior Oil	8 gal/acre
	Parathion	0.75 AI/acre
	Thiodan®	2.25 AI/acre
April 28 (d'Anjous only)	Karathane®	0.3 lb AI/acre
May 20	Guthion®	1.25 lb AI/acre
July 19	BAAM®	0.60 lb AI/acre
	Parathion	0.75 lb AI/acre
	Plictran®	0.75 lb AI/acre

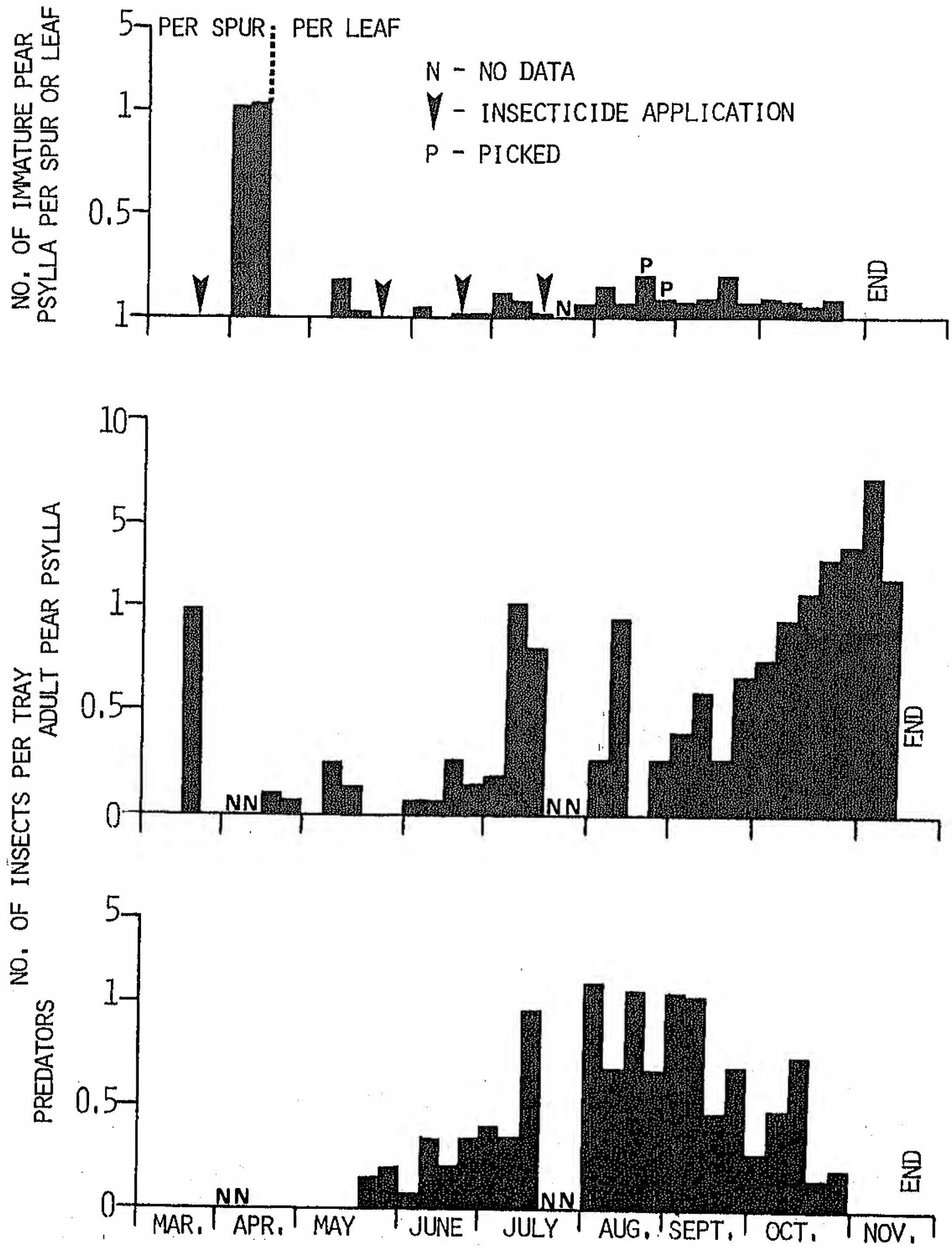

Figure 6.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 2, Zillah, Wash., 1978.

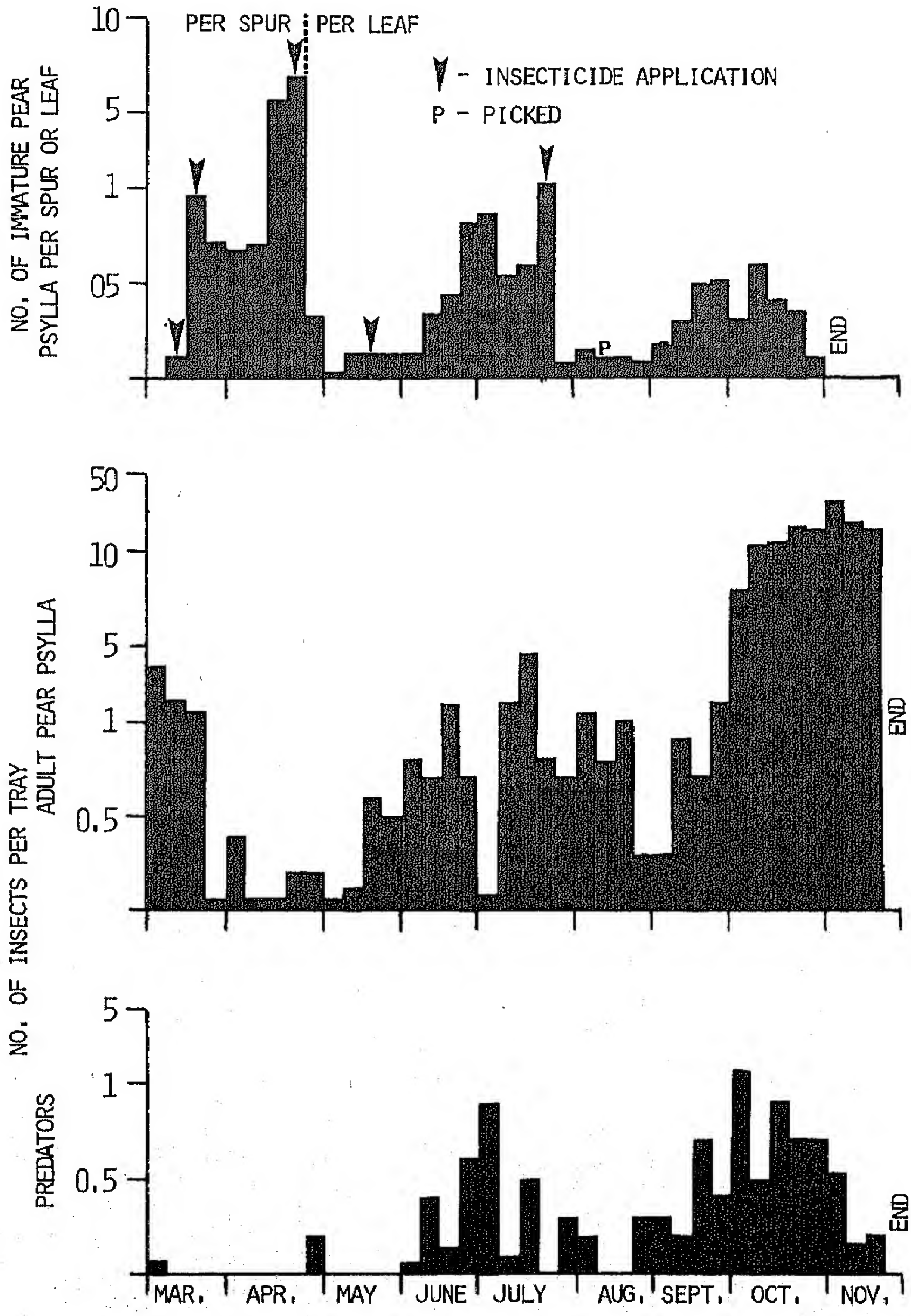

Figure 7.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 2, Zillah, Wash., 1979.

Grower 3 (fig. 8)

Location: 4 miles north of Zillah.

Situation: Young orchard nearing maturity with interplanted younger Open range land on east, mature apple orchards on north and south, prepared orchard land on west. Strong slope facing west.

Irrigation: Overhead sprinkler.

Ground cover: Quack grass with strong admixture of dandelions and o broadleafed weeds.

Insecticide applications:

1979

March 13-14	Pydrin®	0.2 lb AI/acre
	Superior Oil	3 gal/acre
June 1	Guthion®	0.63 lb AI/acre
	Plictran®	1.00 lb AI/acre

Grower 4 (figs. 9 and 10)

Location: West Wapato area in Lower Yakima Valley. Near Coe and La

Situation: Bearing orchard (4.5 acres) of Bartletts with d'Anjou pol tors. Apples on north, south, and west. Wasteland east.

Irrigation: Rill.

Ground cover: Cultivated early with increasing cover of weeds as sea progressed.

Insecticide applications:

1978

March 7	Superior Oil	4 gal/acre
	Perthane®	4 lb AI/acre
March 26	Parathion	0.5 AI/acre
	Superior Oil	3 gal/acre
	Lime sulfur	3 gal/acre
July 11	Plictran®	0.75 lb AI/acre
July 20	BAAM®	1.1 lb AI/acre
	Guthion®	1.0 AI/acre

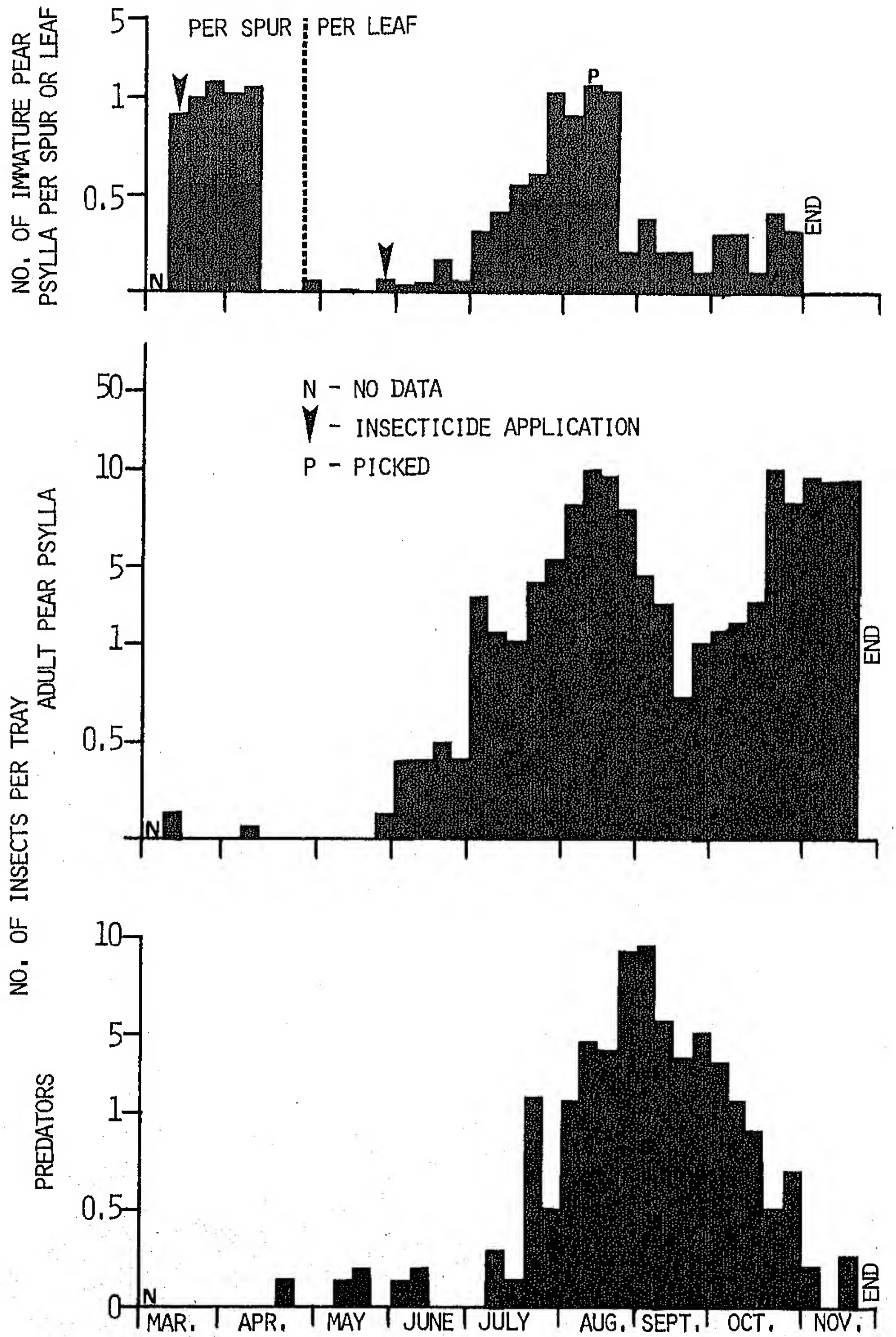

Figure 8.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 3, Zillah, Wash., 1979.

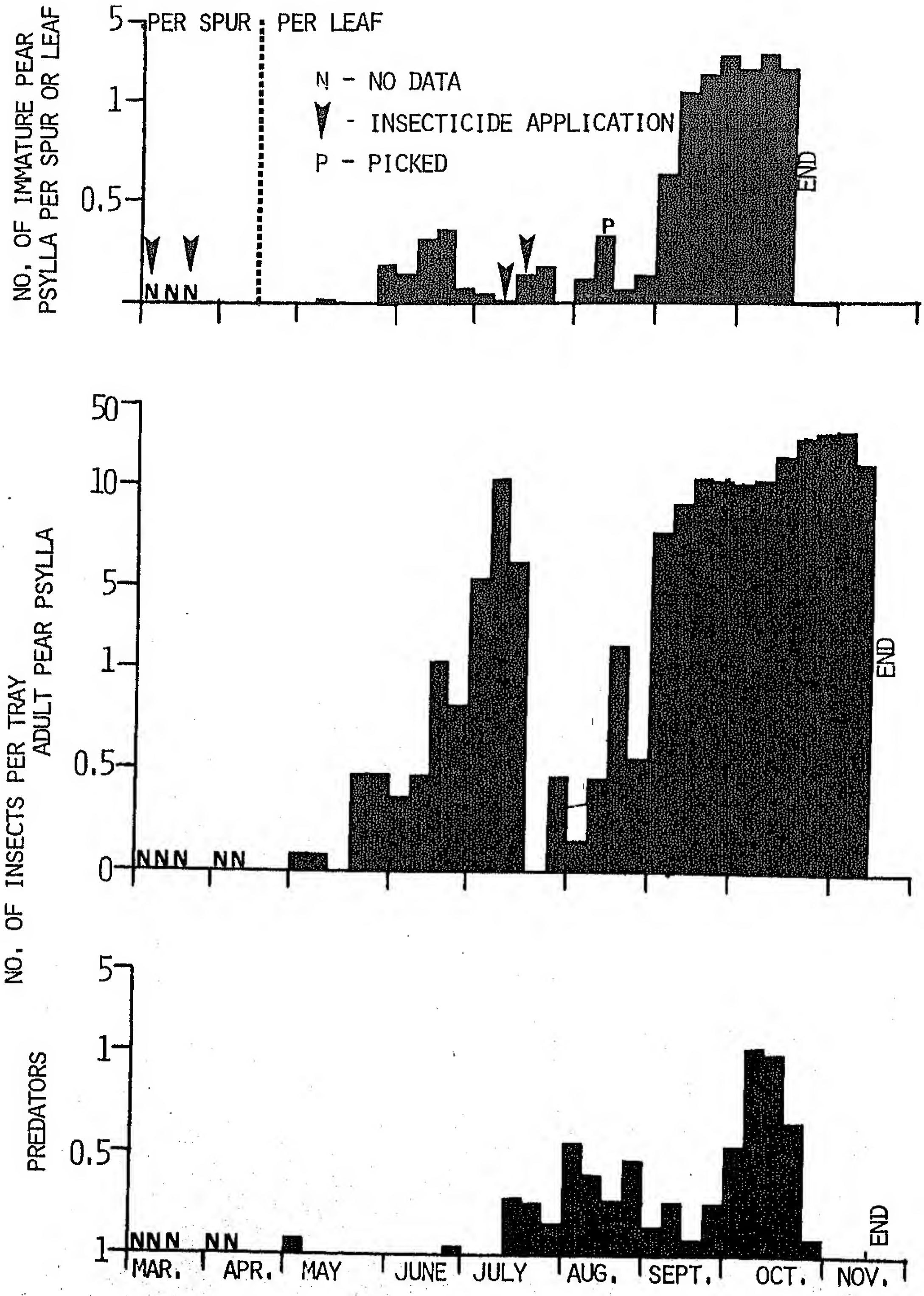

Figure 9.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 4, Wapato, Wash., 1978.

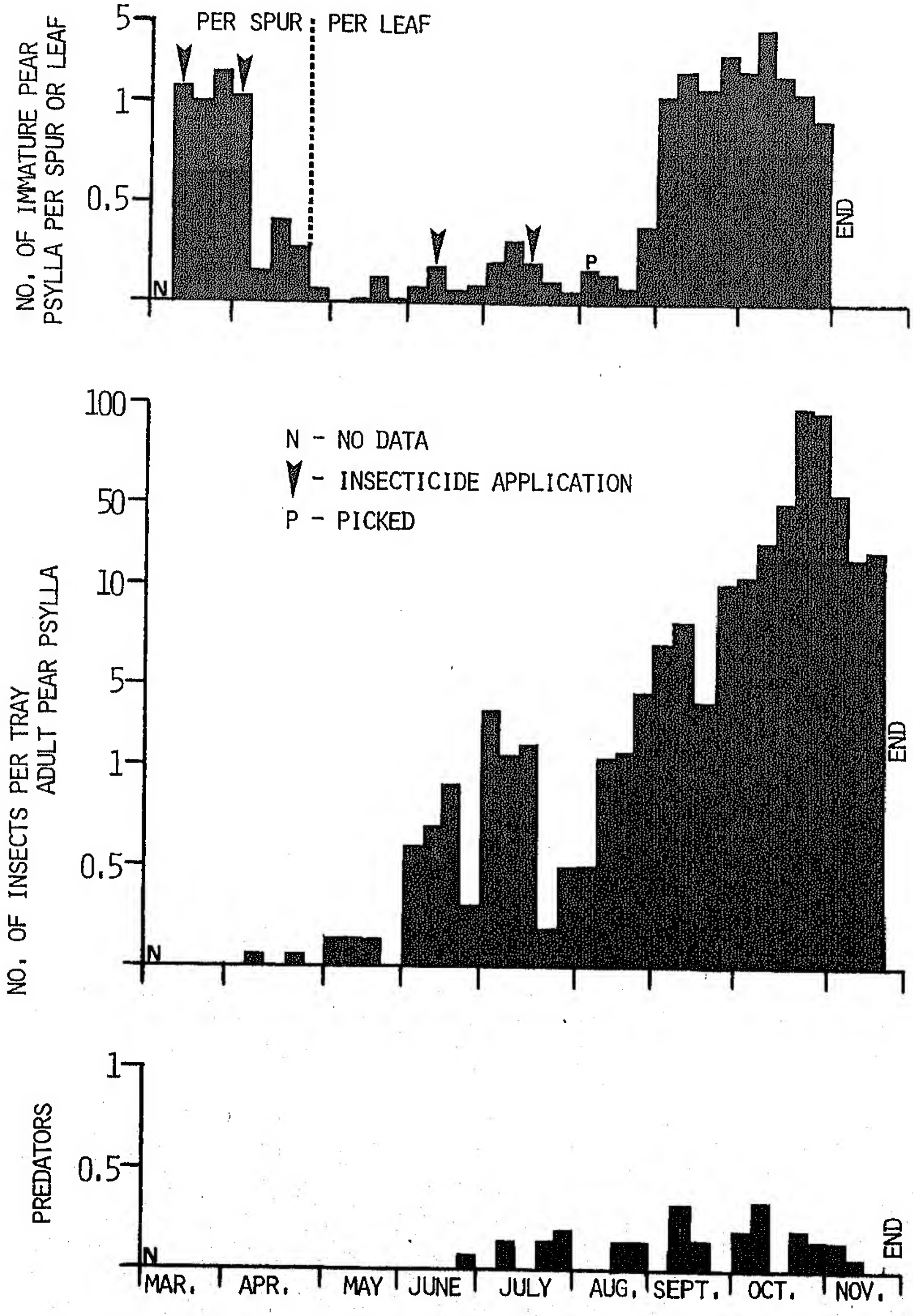

Figure 10.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 4, Wapato, Wash., 1979.

Insecticide applications: (Continued)

1979

March 12	Pydrin®	0.3 lb AI/acre
	Superior Oil	4 gal/acre
April 7	Morestan®	0.63 lb AI/acre
	Parathion	0.75 lb AI/acre
June 15	Plictran®	0.5 lb AI/acre
	Imidan®	1.5 lb AI/acre
July 18	BAAM®	0.3 lb AI/acre
	Imidan®	1.5 lb AI/acre

Grower 5 (figs. 11 and 12)

Location: Cowiche.

Situation: Triangular orchard (7 acres) with large cold storage facility on northeast, open area with dwellings and farm buildings on south, apple orchard on west. Bartlett trees of uneven age from young trees to mature. Some d'Anjous and trees from other cultivars.

Irrigation: Rill.

Ground cover: Clean cultivation early with increasing weed stand to harvesttime.

Insecticide applications:

1978

March 22	Pydrin®	0.3 lb AI/acre
April 14	Lime-sulfur	12 gal/acre
July 6	Imidan®	3 lb AI/acre
	Ethion	1.5 lb AI/acre
July 24	Imidan®	3 lb AI/acre
	Ethion	1.5 lb AI/acre

1979

March 21	Pydrin®	0.3 lb AI/acre
April 25	Morestan®	1 lb AI/acre
	Solabar®	4 lb AI/acre
June 20	Imidan®	3 lb AI/acre
	Ethion	1.5 lb AI/acre

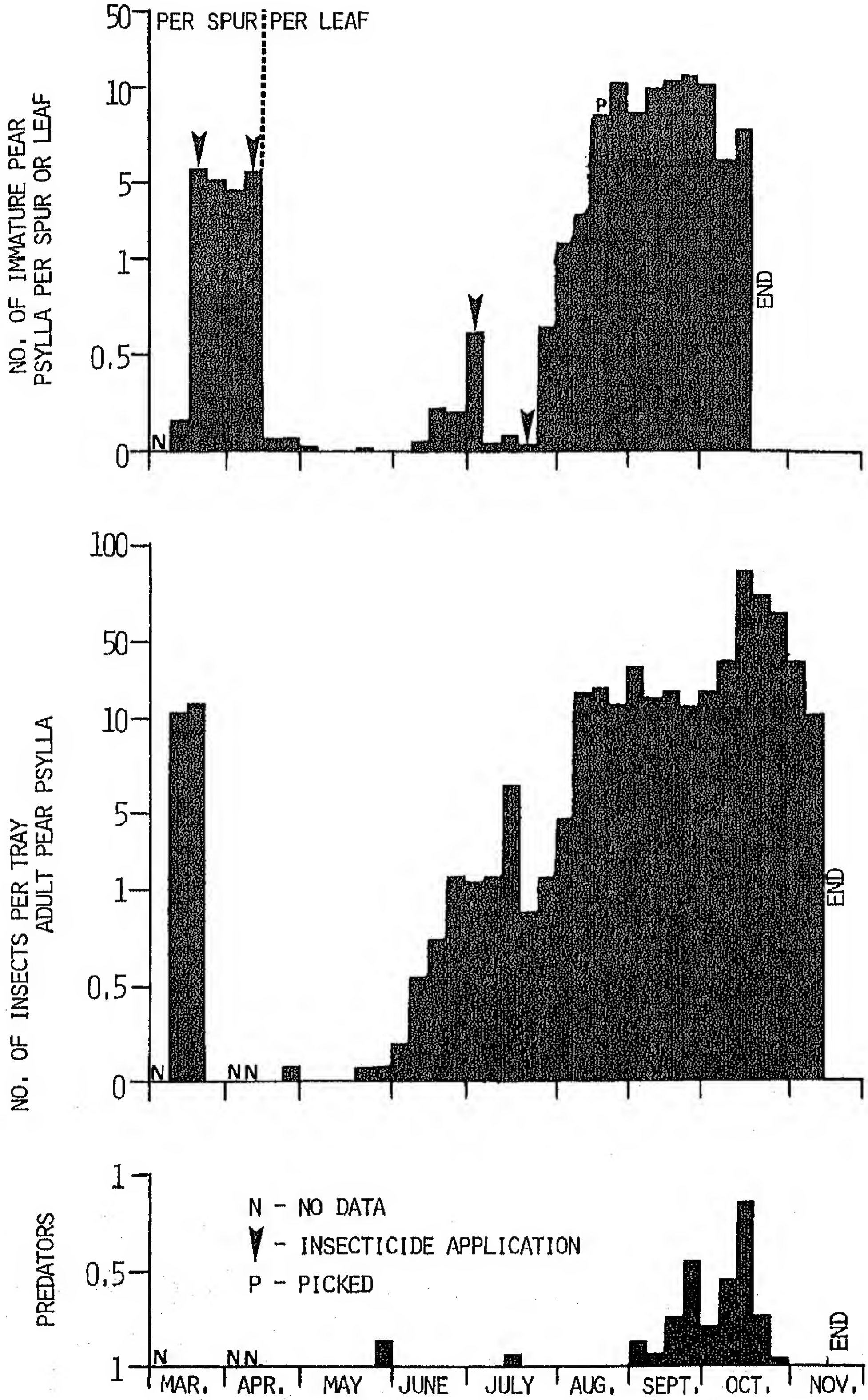

Figure 11.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 5, Cowiche, Wash., 1978.

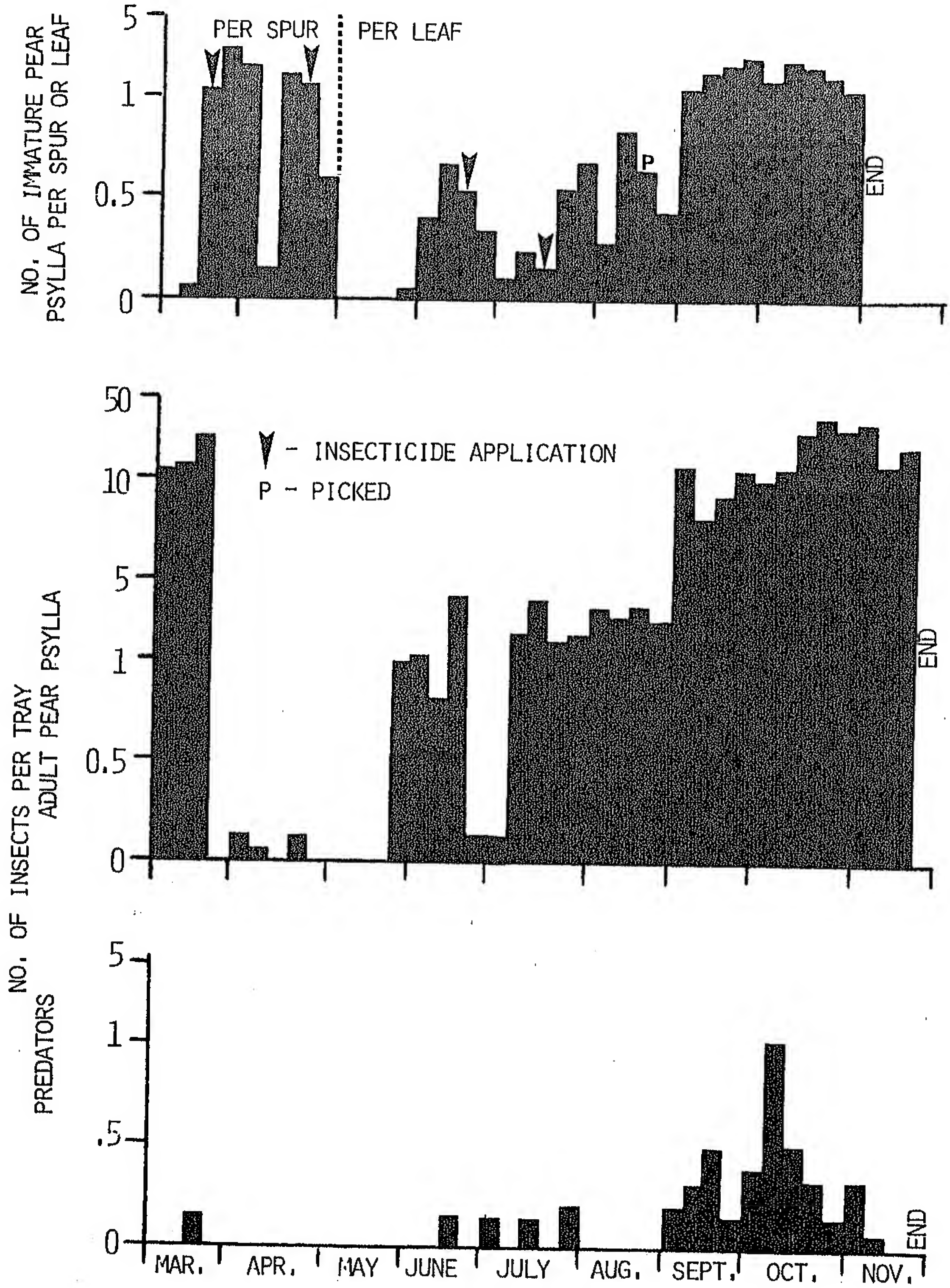

Figure 12.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 5, Cowiche, Wash., 1979.

Insecticide applications: (Continued)

1979

July 19	Imidan®	3 lb AI/acre
	Ethion	1.5 lb AI/acre
	Plictran®	0.5 lb AI/acre

Grower 6 (fig. 13)

Location: Tieton.

Situation: Orchard (4.0 acres) about 15 years old with interplanted young trees. Open rangeland on south and west, mature apples orchard on north, with young and mature apple orchard on east. Weedy ground cover, mainly dandelions and field bindweed, early in season. Heavily rototilled in midsummer with considerable regrowth in late summer and fall.

Irrigation: Undertree sprinkler.

Insecticide applications:

1979

March 7	Superior Oil	2 gal/acre
	Pydrin®	0.3 lb AI/acre
June 26	Plictran®	1.0 lb AI/acre
July 3	Detergent (White King D®)	10 lb/acre
July 6	Detergent (White King D®)	10 lb/acre
July 27	Detergent (White King D®)	10 lb/acre

Grower 7a and b (figs. 14-16)

Location: Naches.

Situation:

(a) Ten acres of uneven age trees from recent replacements to scattered mature trees. North end abuts railroad right-of-way with rangeland beyond. Young apple orchard to east. Mature apple orchard on south with bearing peach orchard on west.

(b) Scattered young bearing pear trees in bearing apple orchard.

Irrigation: Ground level hand lines--sprinkler.

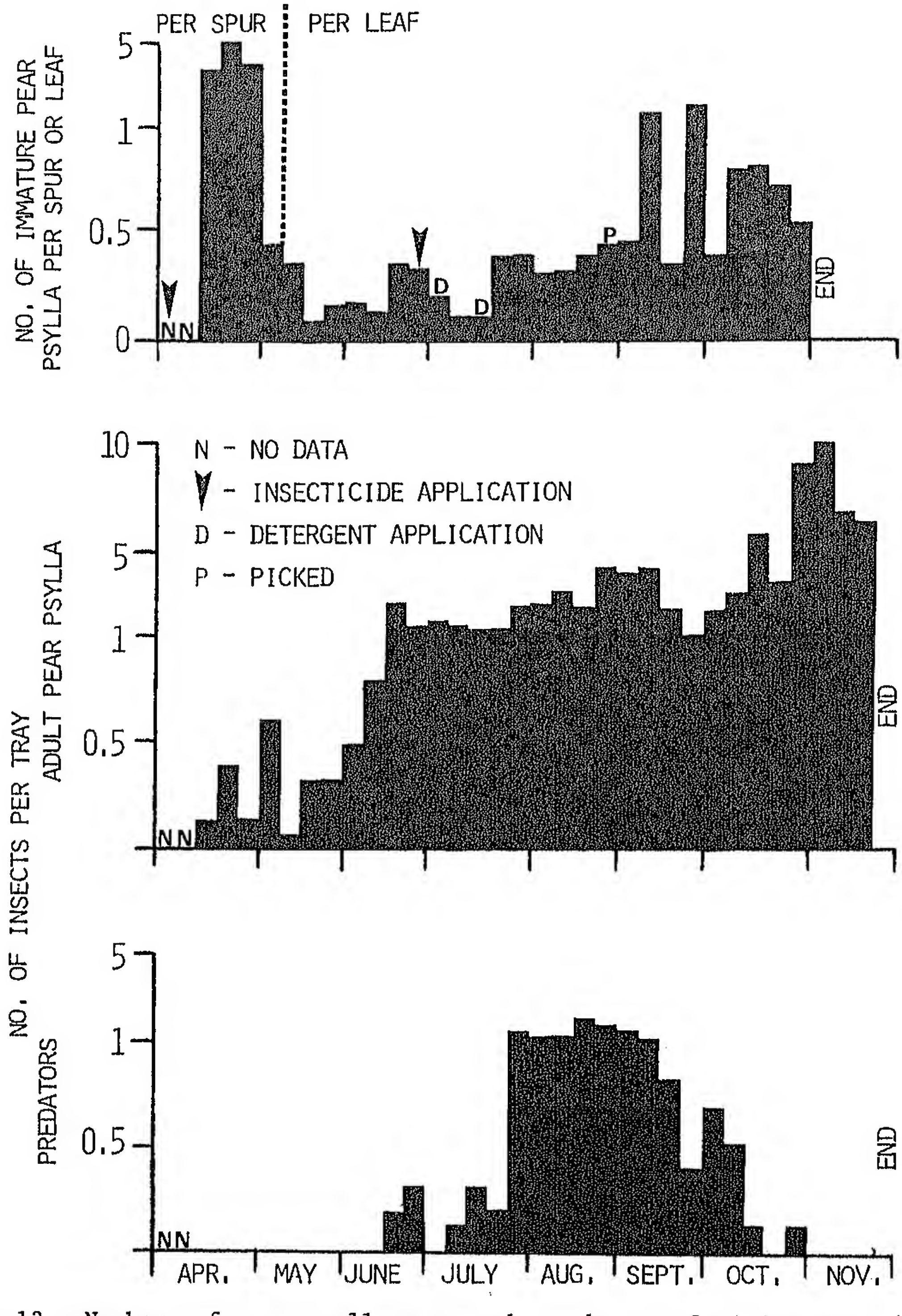

Figure 13.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 6, Tieton, Wash., 1979.

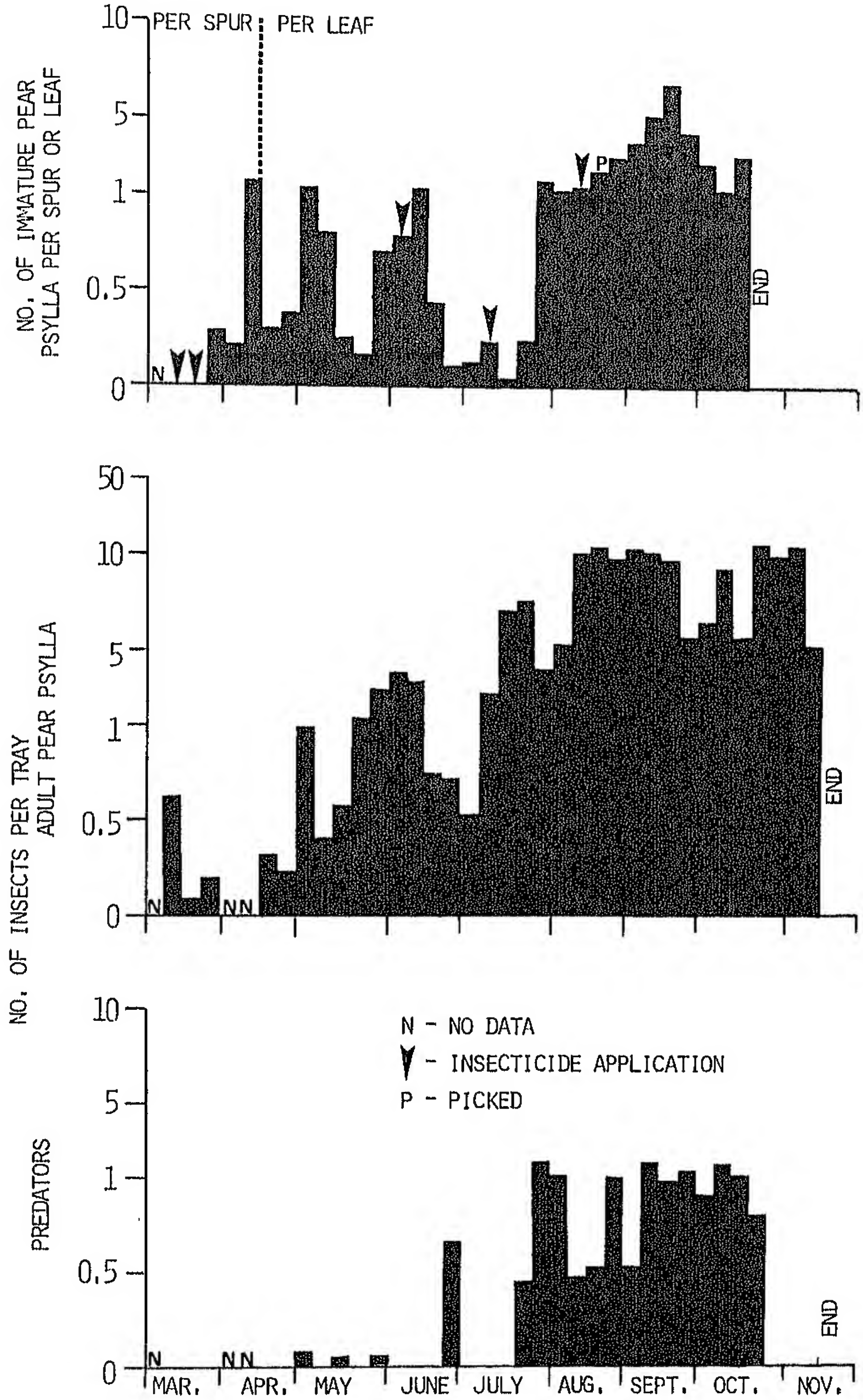

Figure 14.--Numbers of pear psylla eggs and nymphs per fruiting spur (early season) or leaf (late season) and numbers of adult pear psylla and predators per tray. Grower 7a, Naches, Wash., 1978.

Ground cover:

(a) Thick sod with strong complement of dandelions.
(b) Thick sod intermixed with red clover.

Insecticide applications:

1978a

March 13	Pydrin®	0.3 lb AI/acre
March 25	Superior Oil	2 gal/acre
June 5	Ethion	1.5 lb AI/acre
	BAAM®	0.75 lb AI/acre
July 12	Ethion	1.5 lb AI/acre
	BAAM®	0.75 lb AI/acre
August 1	Imidan®	3 lb AI/acre

1978b - Cover spray program for apples

2 applications	Guthion®	2.0 lb AI/acre

1979

March 17	Pydrin®	0.3 lb AI/acre
April 5	Superior Oil	2 gal/acre
	Calcium polysulfide	10 lb/acre
May 25	Plictran®	0.75 lb AI/acre
June 10	Imidan®	2.5 lb AI/acre
July 10	Imidan®	2.5 lb AI/acre
	Ethion	1.25 lb AI/acre
August 2	Imidan®	2.5 lb AI/acre
	Plictran®	0.63 lb AI/acre

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